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Evaluation of Regional Sediment Management Actions Using Government Shallow Draft Dredges

by Richard Thorsen and Monica Chasten

PURPOSE. This Coastal and Hydraulics Engineering Technical Note (CHETN) documents a workshop that evaluated ways to improve Regional Sediment Management (RSM) on projects in the US Army Corps of Engineers (USACE) North Atlantic Division (NAD) and South Atlantic Division (SAD) that use Federal government shallow draft dredges.

INTRODUCTION. Government shallow draft dredges operated by US Army Engineer District, Wilmington (SAW) serve multiple projects along the Atlantic Coast. Although operational schedules are regularly coordinated between SAW and user Districts within SAD and NAD, there has been little (if any) technical coordination to use these dredges to promote and achieve more efficient sediment management. In recognition of this, a workshop was conducted 18-19 January 2012 at SAD Headquarters in Atlanta, GA, to provide the opportunity to share shallow draft project specifics and lessons learned across Division lines, to evaluate new ways to use and manage sediment, to improve value (maximize productivity, reduce cost, and optimize across business lines), to gain operational efficiencies, and to determine how to best leverage the capabilities of the government shallow draft dredge fleet.

METHODOLOGY. A 1-day workshop that would bring SAW (the dredge owner/operator) together with other shallow draft dredge user Districts within SAD and NAD, was considered to be the most cost-effective and expeditious method to attain the goals of this initiative. This workshop provided an opportunity to gather information, data, and knowledge gained from a multitude of shallow draft projects within the combined SAD and NAD areas of responsibility and to assemble the individuals most knowledgeable of these projects to evaluate regional solutions. Findings and recommendations were drawn from a series of presentations, supplemented with active discussion among workshop attendees.

The workshop was attended by representatives of the US Army Engineer Research and Development Center (ERDC), NAD, SAD, and the following USACE Districts: New England, New York, Philadelphia, Baltimore, Norfolk, Wilmington, Charleston, Savannah, Jacksonville, and Mobile. The workshop agenda included an overview of the USACE RSM program followed by individual briefings by each District representative on their respective shallow draft dredge projects. For the purposes of this workshop, District project overviews included:

- Shallow draft dredge projects that are currently funded;
- Shallow draft dredge projects that were typically funded prior to the FY12 budget cuts to low-use navigation projects; and
- Projects that are potentially capable of being done by the shallow draft dredges, if additional funding or shallow draft dredge capabilities (i.e., direct pump-out) were provided.

Report Documentation Page			Form Approved OMB No. 0704-0188		
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE MAR 2013		2. REPORT TYPE		3. DATES COVERED 00-00-2013 to 00-00-2013	
4. TITLE AND SUBTITLE Evaluation of Regional Sediment Management Actions Using Government Shallow Draft Dredges			5a. CONTRACT NUMBER		
			5b. GRANT NUMBER		
			5c. PROGRAM ELEMENT NUMBER		
6. AUTHOR(S)			5d. PROJECT NUMBER		
			5e. TASK NUMBER		
			5f. WORK UNIT NUMBER		
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) US Army Engineer Research and Development Center, Coastal and Hydraulics Laboratory, 3909 Halls Ferry Road, Vicksburg, MS, 39180			8. PERFORMING ORGANIZATION REPORT NUMBER		
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)			10. SPONSOR/MONITOR'S ACRONYM(S)		
			11. SPONSOR/MONITOR'S REPORT NUMBER(S)		
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 8	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

Specific information for each project included:

- Location;
- Depth;
- Frequency/dredging cycle;
- Environmental windows/restrictions;
- Volume;
- Sediment type;
- Material placement location; and
- Coordination/construction challenges.

In addition, District overviews included discussion points for lessons learned and potential regional/RSM links.

SAW representatives discussed the capabilities and operational aspects (i.e., cost, scheduling) of the government shallow draft dredge fleet, consisting of four vessels: (1) the CURRITUCK, (2) the MERRITT, (3) the MURDEN, and (4) the SNELL (Figures 1–4). The workshop also served as a platform to discuss these capabilities and operational aspects with regard to other ongoing related initiatives such as (1) the initiative to streamline the Memorandum of Agreement (MOA) process for accepting contributed funds from local stakeholders, (2) the low-use navigation prioritization initiative, and (3) the evaluation of low-use shallow draft projects maintained by using government shallow draft dredges.



Figure 1. USACE split-hull hopper dredge CURRITUCK.



Figure 2. USACE side-caster dredge MERRITT.

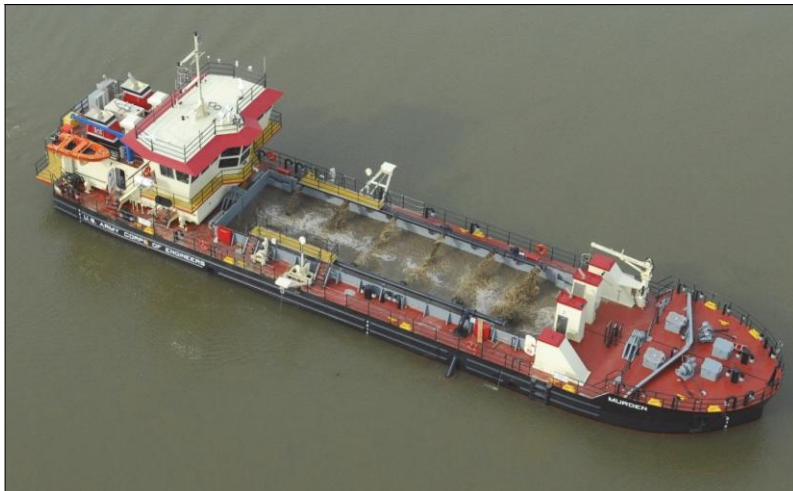


Figure 3. USACE split-hull hopper dredge MURDEN.



Figure 4. USACE clamshell bucket dredge SNELL.

DISCUSSION. The shallow draft dredge fleet efficiently and cost-effectively maintains many low-use shallow draft projects in the NAD and SAD region. Since these projects typically receive limited funds, in many cases they cannot be dredged as often as needed. It is less expensive for Districts to use the shallow draft dredge fleet for these projects than to employ private industry dredges since the Corps fleet incurs no acquisition costs, contract administration costs, or mobilization costs other than the cost to transit the dredge to the project site. In many areas, the government shallow draft dredges are highly valued by public and local stakeholders; they are a reassuring presence in the region.

The government shallow draft dredge fleet is operated by SAW, and consists of these vessels:

- The CURRITUCK, a 300 yd³ capacity split-hull hopper dredge that is used for many projects along the Atlantic Coast;
- The MERRITT, a side-caster dredge used only in areas where side casting is permitted;
- The MURDEN, a new 500 yd³ capacity split-hull hopper dredge that entered service in June 2012;
- The SNELL, a utility vessel equipped with a clamshell bucket for mechanical dredging. This vessel also has a submersible pump that can be used for hydraulic dredging and for pumping ashore. Non-dredging functions of the SNELL include sediment sampling (vibracore), debris collection, and clearing and snagging.

One of the goals of RSM is to integrate sediment management across business lines. The workshop discussion made it abundantly clear that the shallow draft dredge fleet is useful for both navigational dredging and beach nourishment projects. A key element of the RSM program is adaptive sediment management that:

- Identifies opportunities to reduce offshore placement and increase near-shore placement;
- Executes these opportunities; and
- Monitors the effectiveness of these practices in keeping sediment in the littoral zone and adjusts practices as required.

One concept recognized to improve the effectiveness of sediment management is the leveraging of work across business lines. The opportunity to leverage work across business lines may present itself in either of two ways:

- Funds for beach nourishment projects, where the borrow area is a nearby navigation channel in need of maintenance, can help pay for channel maintenance; or
- Funds for navigation channel projects, where the placement location is a nearby beach in need of nourishment, can help pay for beach nourishment.

Some current practices, such as the use of Dredge Material Management Plans (DMMPs), can actually result in lost opportunities if they impose constraints that limit optimal sediment management and adaptive management. For example, the location of some offshore placement sites may actually allow sediment to migrate back into the navigation channel. Conversely, some beach nourishment areas may lose sand and thereby cause shoaling of a nearby navigation channel. Such negative effects may be further compounded when projects are not coordinated

between Districts; the actions of one District may inadvertently harm another District's project. Sediment management must be coordinated across business lines using a regional approach.

A life cycle approach is necessary when considering the cost-effectiveness of projects. For example, the placement of the dredged material further from a channel may reduce the shoaling rate. Such an action implies a tradeoff; more distant placement increases transport costs for each dredging event, but also lowers dredging costs by increasing the time it would take for the channel to shoal, and thereby increasing the time between dredging events. While the migration of sediment may be well understood for some projects, further analysis is required for other projects. The overall goal is to reduce the average annual cost of the project while optimizing sediment use.

Effective sediment management must also consider the perceptions of local stakeholders and the public. For example, local stakeholders and the public may not understand that near-shore placement of sediment (which provides no immediate noticeable result) is a cost-effective and beneficial alternative to placing sand directly on a beach. Educating local stakeholders and the public is vital; once the cost-effectiveness and benefit of these practices are demonstrated, acceptance and support are more likely to follow. This is especially important in those cases where the reduction in Federal funding for low-use channels shifts the burden to local stakeholders who must provide their own funds to perform maintenance dredging.

Direct pump-out capability has the potential to increase the number of projects that can be performed with the shallow draft dredge fleet. Currently, only the SNELL carries the capability to pump material. This is done with a submersible pump suspended from a deck crane and placed in direct contact with the bottom. The pump discharges the material ashore via a pipeline.

The SNELL carries 3,000 ft of 10-in.-diameter pipe. The two hopper dredges (the CURRITUCK and MURDEN) do not have dedicated pump-out equipment, and would require the use of either:

- Submersible pumps, such as the SNELL's, taking suction from their hoppers and pumping ashore; or
- Dedicated pump-out equipment, mounted/installed on each vessel, to pump material ashore.

At present, direct pump-out using the CURRITUCK or MURDEN would require the SNELL to work alongside, using the SNELL's submersible pumps and pipeline. However, the use of direct pump-out for the shallow draft dredges may only be cost-effective for relatively small dredge quantities. Private industry dredges may be better suited to pump-out relatively higher dredge quantities, since they can likely complete the project more quickly than a government shallow draft dredge, even though other costs would be incurred (i.e., acquisition, contract management, and mobilization).

Restrictions on sediment placement vary widely within the collective NAD and SAD region. For example, locations in the SAD region allow practices such as thin layer disposal and side casting. (Thin layer disposal calls for a relatively wide dispersal of sediment over a very large area, effectively spreading out the material in very thin layers.) A SAW representative cited a project where thin layer disposal is used to place sediment in marsh areas. The MERRITT, which is a side-caster, can only work specific areas within the SAD region. Locations in the NAD region do not

allow thin layer disposal. In the NAD region, near-shore disposal of sediment is permitted in many areas along the coast but not along the south shore of Long Island. Further research and assistance from ERDC is needed to evaluate regional environmental regulations supported by science.

FINDINGS AND RECOMMENDATIONS. The workshop discussion produced the following findings and recommendations:

1. Direct pump-out capability could expand and enable improved sediment management. A question exists as to whether it can be done efficiently and cost-effectively with a shallow draft dredge. Possible ways to accomplish this include use of the SNELL as a pump-out support vessel to the CURRITUCK and MURDEN, or the possible addition of dedicated pump-out equipment to the CURRITUCK and MURDEN. The latter option would require acquisition of dedicated pump-out equipment through the Plant Replacement and Improvement Program (PRIP), supported with an economic analysis to show that projects can pay for this investment over its service life. The second option would also require some modifications to both vessels for equipment installation. Representatives of the US Army Engineer Marine Design Center (MDC) indicated that the MURDEN was constructed with this possibility in mind, and that it contains the required electrical distribution equipment to support direct pump-out.
2. SAW recommends conducting a pilot direct pump-out operation using the SNELL as a support vessel to the CURRITUCK or the MURDEN to collect data and to facilitate an analysis of feasibility and cost-effectiveness of such an operation. At the workshop, the Jacksonville District (SAJ) suggested that Palm Beach, FL should be evaluated as a pilot project for direct pump-out, as it will have the support of local stakeholders.
3. Following the workshop, two additional pilot projects were identified by workshop participants as potential opportunities to obtain additional data and information regarding the capability of the government shallow draft dredges to accomplish RSM goals:
 - a. One initiative involves use of the SNELL alongside the CURRITUCK or MURDEN to test direct pump-out of the shallow draft dredge hoppers with the Mathews County, VA, RSM project as a potential test site.
 - b. Another initiative involves use of the SNELL to pump sediment directly from a section of the Sandy Hook Bay Federal channel onto an adjoining beach at Leonardo, NJ.

These initiatives will capture useful information and data on the cost, scheduling, logistical considerations, and production capability of the equipment/setup necessary to accomplish direct pump-out operations. These initiatives will be coordinated and scheduled between the project-owning Districts and SAW. ERDC can support these efforts through several research programs, as needed. Future tech notes will report the results of these initiatives.

4. A systems approach is recommended for managing low-use shallow draft projects at the regional level. Elements of a systems approach include:
 - a. Determination of optimum, private–industry/government shallow draft dredge utilization;
 - b. Optimal scheduling of all dredging work to leverage mobilization and demobilization transit times between projects;
 - c. A well-coordinated regional steering committee that essentially facilitates prioritization, work planning, and asset utilization on a regional level and across business lines;

- d. Consistent criteria, methodologies, processes, and policy to facilitate the functions of the regional steering committee;
 - e. Technical data analyses and RSM tools to determine sediment transport patterns and pathways for more efficient sediment management using the shallow draft fleet. Sediment budgets across the region can be developed and used to help with RSM actions;
 - f. Low-cost analysis methods to implement potential sediment management opportunities in a short timeframe. Simple modeling tools should be developed to help identify suitable near-shore sites; and
 - g. Environmental considerations and permitting actions using science-based decision making. Restrictions and constraints on placement differ within the collective NAD/SAD region based on individual state requirements. Additionally, the use of the fine grained material in the coastal zone should be explored and lessons learned developed.
5. The value of near-shore placement versus offshore placement must be explored further, as additional research is required to determine the benefits of keeping finer grain sand in the littoral system.
6. Much can be gained by leveraging work across business lines. Not only is there a potential for collective cost savings, but leveraging may eliminate conflicts between projects where one project's actions work conflict with another's. It is recognized, however, that standalone project authorizations may hinder efforts to collaborate. This issue must be explored further to ensure that collaboration across business lines can occur where feasible.
7. Three ongoing initiatives are closely related to this workshop initiative:
- a. Streamline the MOA process for accepting contributed funds from local stakeholders. This initiative is focused on reducing the time and effort required to accept non-Federal funds to dredge projects, particularly those that are low-use/shallow draft and do not compete well for Federal funds. Local stakeholders have shown considerable interest and willingness to provide funds. However, without a streamlined process to accept those funds, projects cannot be dredged in a timely way, and local stakeholders may consequently be discouraged from contributing funds;
 - b. Evaluate low-use shallow draft projects maintained by using government shallow draft dredges (Low-Use Pilot Program Initiative). This initiative is focused on introducing low-use shallow draft stakeholders to a capability that is unfamiliar to them, but that can provide their navigation needs. This initiative aims to develop future MOAs for contributed fund agreements; and
 - c. Perform low-use prioritization (Navigation Strategic Initiative). This initiative focuses on providing a risk-based methodology to prioritize low-use projects for navigation dredging.
- All of these initiatives must be considered together in the context of a comprehensive low-use shallow draft programmatic strategy.
8. Joint NAD/SAD government shallow draft dredge schedule meetings, held in conjunction with larger dredging meetings (e.g., the National Dredging Meeting, Western Dredging Association), have been effective in promoting regional coordination and communication between Districts and Divisions. Discussion should be expanded to include lessons learned and innovative ideas that will continue to improve the value of the government shallow draft dredge assets to projects.

ADDITIONAL INFORMATION. This Coastal and Hydraulics Engineering Technical Note (CHETN) was prepared as part of the Regional Sediment Management (RSM) Program, and was written by Richard Thorsen, US Army Engineer Division, North Atlantic, and Monica Chasten, US Army Engineer District, Philadelphia. Additional information pertaining to the Regional Sediment Management program may be found at the RSM web site <http://rsm.usace.army.mil>.

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This tech note should be cited as follows:

Thorsen, R., and M. Chasten. 2013. Evaluation of regional sediment management actions using government shallow draft dredges. ERDC/CHL CHETN-XIV-26. Vicksburg, MS: US Army Engineer Research and Development Center, Coastal and Hydraulics Laboratory (ERDC-CHL), <http://chl.erdcl.usace.army.mil/library/publications/chetn/pdf/chetn-xiv-26.pdf>

ACRONYMS AND ABBREVIATIONS.

Term	Definition
CHETN	Coastal and Hydraulics Engineering Technical Note
CHL	Coastal and Hydraulics Laboratory
DMMP	Dredge Material Management Plan
ERDC	Engineer Research and Development Center
MDC	[US Army Engineer] Marine Design Center
MOA	Memorandum of Agreement
NAD	[US Army Corps of Engineers] North Atlantic Division
POC	Point of Contact
PRIP	Plant Replacement and Improvement Program
RSM	Regional Sediment Management
SAD	[US Army Corps of Engineers] South Atlantic Division
SAJ	[US Army Corps of Engineers] Jacksonville District (SAJ)
SAW	US Army Engineer District, Wilmington
US	United States
USACE	US Army Corps of Engineers

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